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Editorial

Special Issue "10th Anniversary of Catalysts: Biocatalysis in Analysis and Synthesis—Past, Present and Future"

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The milestone of the 10th anniversary of *Catalysts* is a great time to reflect on past accomplishments, present progress and challenges, as well as to identify future challenges and opportunities. Biocatalysis has moved from a niche area of catalysis to the forefront as a key enabling technology for successfully addressing challenges in the fields of organic synthesis and analysis. This is also illustrated by the continuous growth of the "Biocatalysis" section of *Catalysts*, with a total number of 130 Special Issues, from which 32 are active online and 98 have been completed, and a total number of 761 articles published to date. As a way of celebrating the 10th anniversary of *Catalysts*, and in view of the key importance of biocatalysis, the "Biocatalysis" section has therefore launched a Special Issue entitled "10th Anniversary of *Catalysts*: Biocatalysis in Analysis and Synthesis—Past, Present and Future".

The enzymatic monoacetylation of diols catalyzed by *Candida antarctica* lipase B is a valuable desymmetrization methodology and has been applied by Madalińska et al. [1] to prochiral phosphines and phosphine *P*-sulfides as a route towards P-chiral catalysts. An enantiomeric excess of 98% and 10% yield could be achieved in the case of bis(2-hydroxymethylphenyl)phenylphosphine when using *C. antarctica* lipase B as a catalyst and *t*-butyl methyl ether/pyridine as a solvent, while 77% enantiomeric excess and 60% yield was the best result achieved in the case of bis(2-hydroxymethylphenyl)phenylphosphine-*P*-sulfide when using lipase from *Pseudomonas fluorescens* as a catalyst and *t*-butyl methyl ether as a solvent [1].

The low-cost liquid lipase Eversa Transform, a variant lipase from *Thermomyces lanuginosus*, was applied by Vieira et al. [2] in the hydrolysis of acylglycerols from soybean oil deodorizer distillate to free fatty acids in high yields, and for the simultaneous esterification/transesterification of soybean oil deodorizer distillate to fatty acid ethylesters in high yields using ethanol as an acyl acceptor.

A simple mathematical tool has been developed by Rodrigues de Sousa et al. [3] for optimizing the syntheses of short, medium or long-chain esters from acids and alcohols using immobilized lipase and solvent-free systems.

The substrate scope, crystal structure, kinetic properties and thermostability of the recombinantly expressed L-amino acid oxidase from *Pseudoalteromonas luteoviolacea* have been determined by Savino et al. [4]. The high expression level, ease of purification, high thermostability and activity on many different L-amino acids make this enzyme not only attractive for the synthesis of enantiopure amino acids or related compounds but also for detection, due to its high catalytic efficiency on a subset of amino acids [4]. The determined crystal structure provides a solid basis for engineering tailor-made variants of L-amino acid oxidase for activity on specific amino acids [4].

The hydrogen-dependent carbon dioxide reductase from *Thermoanaerobacter kivui* was immobilized in a redox polymer on a cathode, and its activity was investigated by Ruth et al. [5] regarding H_2 formation from electricity. A 340-fold increase in the current density

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has been demonstrated in a rotating disk electrode system using cobaltocene-functionalized polyallylamine as a redox polymer paired with the hydrogen-dependent carbondioxide reductase from *T. kivui*, which resulted in significantly higher maximum current densities than for previously reported systems [5].

Cell-free protein synthesis has been used by Rolf et al. [6] as a valuable tool for simplifying and accelerating the identification of novel non-heme Fe^{2+} / α-ketoglutarate-dependent dioxygenases, which can be applied for the selective hydroxylation of L-lysine in the 3- and 4-position in whole-cell biotransformations. Six novel and yet uncharacterized non-heme Fe^{2+} / α-ketoglutarate-dependent dioxygenases from *Kineococcus rhizosphaerae*, *Mycobacterium interjectum*, *Photorhabdus luminescens*, *Burkholderia* sp. MSMB617WGS, *Burkholderia pseudomallei* and *Burkholderia plantarii* with suitable activities have been found and extend the range of enzymes for catalyzing the hydroxylation of L-lysine, whereby further investigations will be of interest for providing the absolute configuration of the resulting 3-hydroxy-L-lysine and 4-hydroxy-L-lysine [6].

The whole genome sequencing of three *Streptomyces* sp. strains, different identification approaches for transaminases and laccases and the functional expression of the corresponding genes have been combined by Ferrandi et al. [7]. They enabled the characterization of a novel transaminase and a novel laccase, which were shown to be exceptionally thermostable. The novel transaminase Sbv333-TA was demonstrated to have a broad substrate scope, including β-ketoesters such as methyl acetoacetate and ethyl benzoylacetate, while improved activity in the presence of the organic solvent acetonitrile was found for the novel laccase Sbv286-LAC [7].

The substrate scope of silicatein-α, a hydrolytic enzyme from siliceous marine sponges of interest for biocatalytic silylation, has been investigated by Sparkes et al. [8] in a series of condensation reactions of triethylsilanol with various aromatic and aliphatic alcohols. The preference of silicatein-α for the silylation of the *S*-enantiomers of aliphatic alcohols and the high degree of conversion in the nonpolar solvents *n*-octane and toluene are good starting points for further evolution as valuable biocatalysts for the synthesis of organosiloxanes [8].

Laccases from *Trametes versicolor*, *Myceliophthora thermophila*, *Bacillus subtilis* and laccase-like multicopper oxidase from *T. thermophila* have been investigated by Milovanovic et al. in the oxidation of 1,4-dihydropyridine-based hexahydroquinolines to the corresponding pyridine-containing tetrahydroquinolines and in the oxidation of 1,4-dihydropyridine-based decahydroacridines to the corresponding pyridine-based octahydroacridines [9].

Phosphotransferases, phosphohydrolases, phosphorylases and phosphomutases are powerful biocatalysts for highly selective and efficient phosphorylation reactions, and their applications have been highlighted by Wohlgemuth [10], including useful phosphoryl donors and systems for their regeneration, reaction engineering, product recovery and purification. Examples of valuable analytical and synthetic applications of phosphorylation biocatalysts are provided, which illustrate the resource efficiency of highly selective phosphorylation reactions proceeding with complete conversion [10].

Biocatalysts, including both protein-based and nucleic acid-based enzymes, can also be utilized for constructing catalyst-based biomolecular logic gates that can read various molecular inputs and provide chemical, optical, and electrical outputs. Progress in constructing logic gates that take advantage of biological catalysts is discussed by Winston and Boehr [11].

The biological synthesis of biodegradable short-chain-length, medium-chain-length and short-medium-chain-length polyhydroxyalkanoates and their applications and recycling have been discussed by Dalton et al. [12].

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